USER NEEDS

The purpose of this Thrust is to provide efficient and affordable instrumentation for Air Force and DoD weapon test requirements. The user needs described below are derived from the the ACC MAP for Strategic Attack/Interdiction, Close Air Support/ Interdiction, the AFSOC Weapon System's Roadmap, 2nd Edition, and the Air Force Test Investment Planning and Programming (TIPP) process.

WEAPONS

Air-to-Surface - All Weapon Options

- Real-time test data
- Blast combustion temperature measurement
- Characterization of behind-panel armor debris
- Warhead effects characterization

TEST AND EVALUATION

Air Force Test Centers

- High Speed Electronic Imaging
- Accurate Time-Space-Position-Information
- Motion holography for wind tunnels
- Subminiature telemetry components

See Figure 8 for major Thrust efforts.

GOALS

This thrust is the only DoD laboratory activity specifically directed toward development of instrumentation technology for weapon Test and Evaluation use. DoD 5000.1 now ties the acquisition milestone decision process to specific exit criteria. This places an imperative on timely test programs, producing accurate and appropriate data to support those decisions.

- The overall goal of this thrust is the development of affordable test instrumentation technology which will allow **dramatic** test cost and schedule reductions for Air Force and DoD weapon acquisition programs**.** The realization of this goal depends upon two activities: development of the appropriate technology and rapid transition to test users. This thrust emphasizes both aspects.

WEAPONS/TEST AND EVALUATION

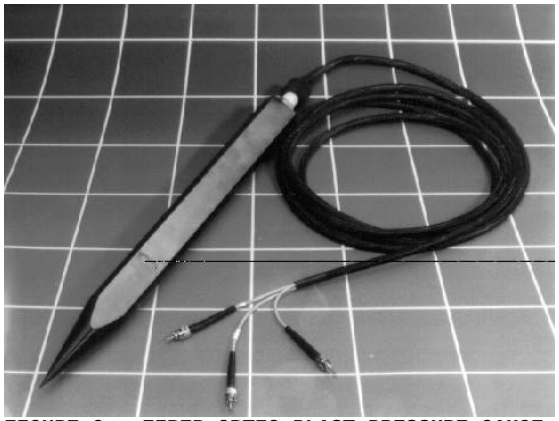

FIGURE 9. FIBER-OPTIC BLAST PRESSURE GAUGE

Real-time telemetry from both air-to-air and air-to-surface developmental weapons is essential for ascertaining whether the system and subsystems functioned properly under realistic flight conditions. Current telemetry systems are too large to allow instrumentation of smaller munitions, submunitions, and missiles. Even where size is not prohibitive, high telemetry system cost has limited instrumented tests to few items.

- Our goal is low cost, subminiature telemetry sets which will support a broad range of weapon test requirements. Implementation is through development of a standard family of specialized telemetry integrated circuit components which can be easily combined into very small weapon specific telemetry systems.

- Near-term goals are to complete development of the Telemetry Instrumentation Development System technology which will provide test users in the field a subminiature telemetry support system. Subminiature telemetry technology is being combined with smart fuze technology to provide operational assessment of weapon function. A low cost spread spectrum demodulator is being developed to receive data from up to 96 instrumented submunitions in simultaneous flight. This technology has great dual use potential for applications such as environmental monitioring of multiple sensors and medical body function monitoring.

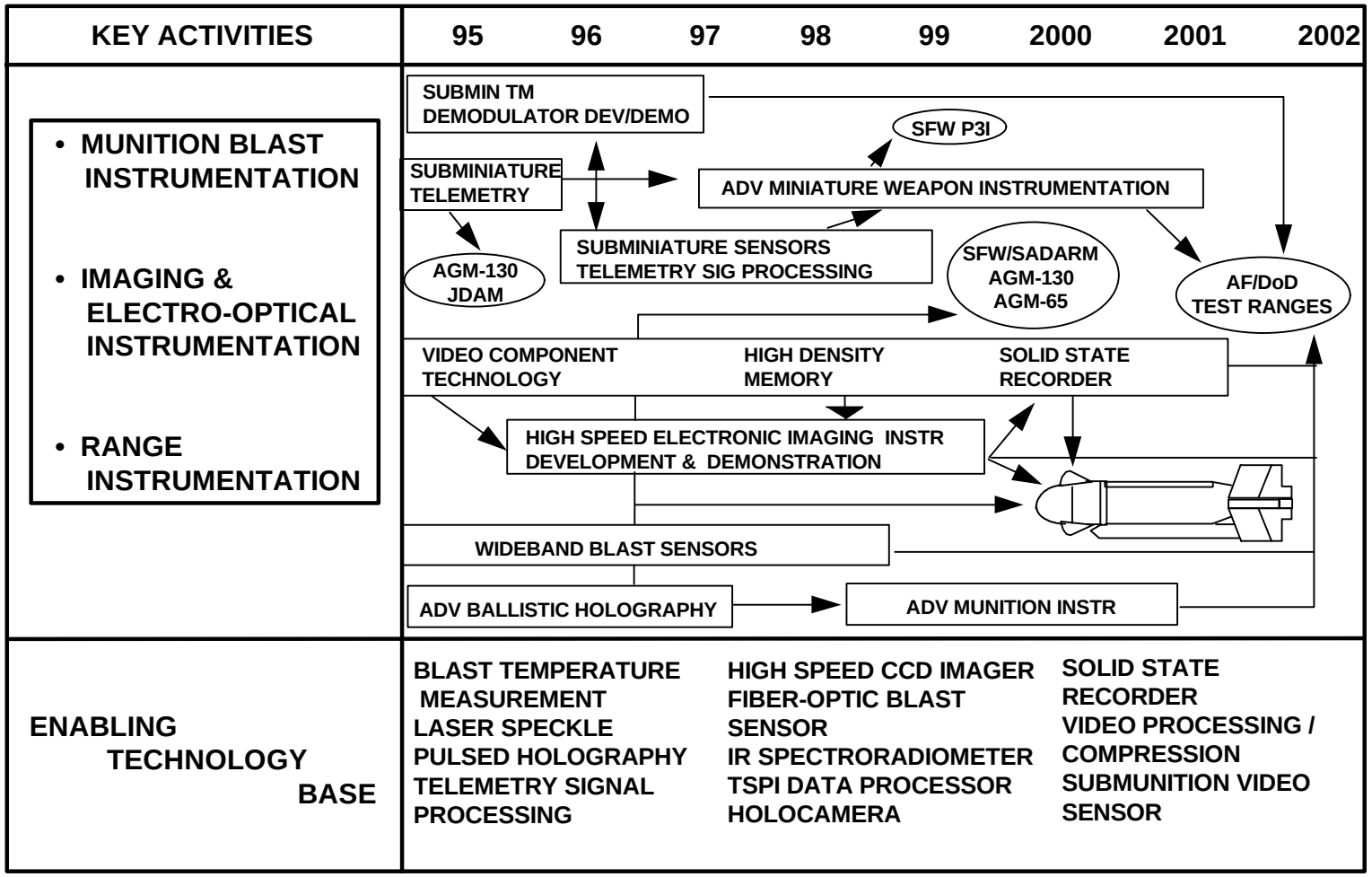

FIGURE 8. THRUST NO. 3 - INSTRUMENTATION

- Payoff will be accurate test data from previously "undoable" weapon test requirements. Telemetry system cost can be greatly reduced while high accuracy data are acquired in digital form. Built-in test capability, installed during weapon production could provide valuable reliability and maintainability data over the full weapon system life cycle while, at the same time, support warfighter training activities. This technology has already been applied to the AIM-120 AMRAAM missile operational telemetry system. AGM-130 and JDAM program offices have recently received subminiature telemetry hardware kits and will support EMD flight tests with them in FY95.

The most widely used form of airborne and ground test data is photography obtained with high speed film cameras. Computer processed metric analysis of high speed film is a standard data gathering technique. Film test data suffer many shortcomings, not the least of which is that film processing takes from days to weeks and data quality is not known until then. Weapon test programs are seriously impeded by film delays. Film processing chemicals are also a serious environmental hazard and present severe operational restrictions.

- Our goal is high resolution, high speed electronic imaging systems which can replace high speed film camera systems and provide test data in real-time. Both airborne and ground applications are being pursued. Modular system components are envisioned to service varying requirements and reduce cost through higher quantity production and commercial use.

- Near-term goals are to 1) develop real-time, high resolution air-to-ground video instrumentation systems and transition to Air Force test centers for immediate improvements to test operations, and 2) develop the individual components needed to support a high speed electronic imaging system advanced development program.

- Payoff will be "film quality" image data that will be available to test and project personnel during the actual conduct of the test. Data quality will be immediately known and scarce test resources can be optimized in real time. Test operational efficiency increases of 300-500% are envisioned. Operational uses such as reconnaissance and strike battle damage assessment are immediate spin-offs of this technology. Elimination of wet-chemical film processing completely solves that environmental problem and improves field deployability. This technology supports virtually every DoD weapon system acquisition. The Aircraft/Weapon Certification Program (SEEK EAGLE) aircraft-weapon compatibility test and certification program alone has postulated savings of several hundred million dollars through shortened flight test programs.

The effectiveness of advanced munitions is, in large measure, dependent upon warhead design, where the development trend is toward intelligent, multimode, and aimable operation. Improved warhead effects instrumentation must be available to support development of new warhead designs. Current warhead effects instrumentation is too costly and does not have sufficient bandwidth to support intra-warhead data acquisition. Warhead fragment pattern analysis is difficult, with the primary data source, high speed X-ray, providing only orthogonal views of the blast event. Present explosive temperature measurement techniques are inaccurate, yielding widely varying answers.

- Our goal is low cost, wideband blast instrumentation to support weapons development thrusts. This includes the development of both sensors and their support equipments. Developments such as the Fiber-Optic blast sensor (Figure 9), will produce a ten-fold increase in blast pressure data bandwidth. Ballistic Holography will yield true three dimensional views of warhead detonations from which fragment sizes, shapes, and velocity vectors can be determined Real-time data output, in a computer compatible format is also a high priority. Accurate measurements of the highly transient explosives reaction temperatures will be pursued.

- Payoff will be more accurate and timely warhead test data to support all Air Force weapon developments. Close-in and intra-warhead measurements will allow researchers to verify and extend hypotheses on basic material chemical and physical reactions. Holographic warhead fragment pattern characterization will ultimately yield increased warhead lethality through improved dispersion analysis. Long range holographic

instrumentation will materially speed warhead arena testing.

MAJOR ACCOMPLISHMENTS

- Developed and delivered subminiature telemetry kits to AGM-130, JDAM, and BMDO program offices for flight test support.

- Developed high speed, high resolution charge coupled device (CCD) electronic imager for use in FY96 new start High Speed Electronic Imaging Instrumentation program.

- Transitioned Time-Space-Position-Information Data Processor (TDP) technology to AFDTC for test mission support use. The TDP can process data in real-time from up to ten test range TSPI sensors tracking aircraft and released weapon position, provide an optimal TSPI estimate, and automatically point remote range instruments for flight test data acquisition.

- Completed development of spectro-radiometer instrument to simultaneously measure spatial and spectral infrared target signatures for DoD-wide test applications.

- Produced first ballistic holograms using new in-house laboratory facility. Conducted very successful experimentation to scale up cylindrical hologram size from 6 inches to 24 inches diameter.

- Helmet Video Camera demonstrated during flight tests at AFDTC.

- First Air Force Test Technology Transition Plan signed with AFDTC for Multiple Submunition Telemetry Demodulator.

CHANGES FROM LAST YEAR

There were no major changes from last year.

MILESTONES

- In FY96, begin experiments in use of long range holography to provide improved warhead arena test data.

- In FY96 complete development of Telemetry Instrumentation Development System to aid test range telemetry users in field use of subminiature telemetry.

- Begin development, in FY96, of telemetry processing technology to increase transmission range of subminiature telemetry, reduce power input requirements, and provide submunition TSPI.

- In FY97 continue development of warhead effects sensors. Demonstrate fiber-optic warhead blast pressure sensor.

- Flight test Multiple Submunition Telemetry Demodulator in FY96. Transition to AFDTC FY97.

- Begin development, in FY97, of ultra-high bandwidth solid state recorder to support next generation munition flight test requirements.

- In FY96 initiate 6.3 High Speed Electronic Imaging Instrumentation demonstration program

- Develop large scale, test range deployable warhead fragmentation measurement system beginning FY96. Test and transition systems in FY97.

- Test warhead blast reaction temperature measurement methods in FY96.